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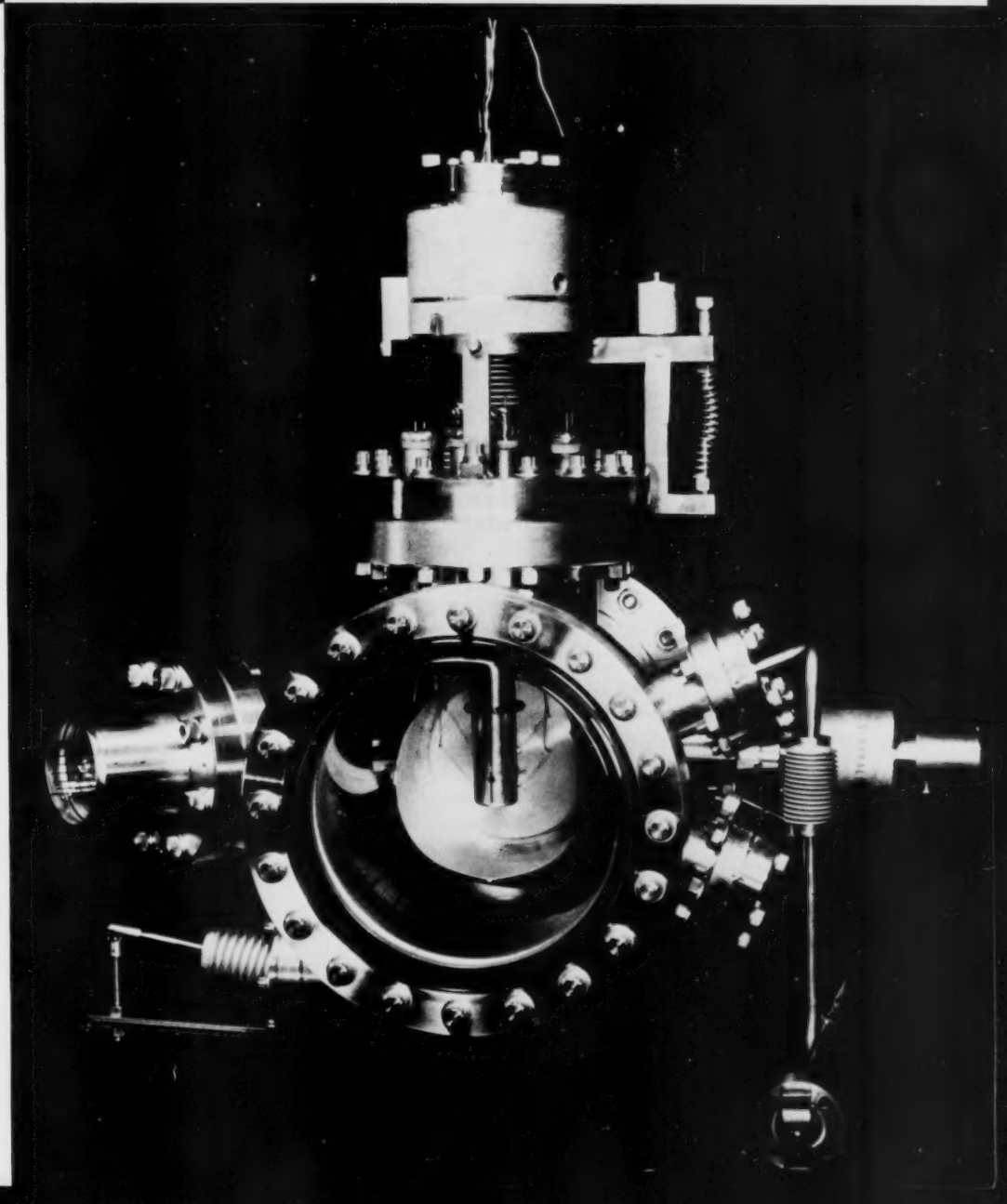
# Technical News Bulletin



UNITED STATES DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS
# Technical News Bulletin
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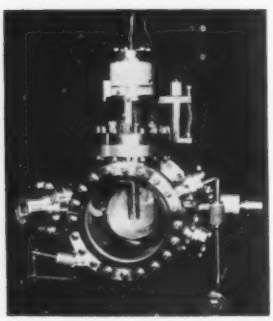

*Cover:* Electron field emission microscope used for analyzing the surface states of electrons from metals. Photo by Howard Clark, NBS Optical Physics Division. See page 153.

**U.S. DEPARTMENT OF COMMERCE**
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NATIONAL BUREAU OF STANDARDS
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The TECHNICAL NEWS BULLETIN is published to keep science and industry informed regarding the technical programs, accomplishments, and activities of NBS.

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# COMPUTER ROAMS DOWNTOWN

MATHEMATICIANS AT THE BUREAU, together with the staff of International Research and Technology, Inc. (IRT), have designed a mathematical model describing the movement of trucks in lower Manhattan, contributing to a larger study by the Department of Housing and Urban Development. This HUD study is directed at demonstrating how operations research and computer simulation techniques can assist urban planners. The NBS contribution was directed by Louis Santone, of the Bureau's Technical Analysis Division (TAD); the portion described below was performed by Judith Gilsinn, of the Bureau's Applied Mathematics Division, and Richard Ku, of TAD.

*A computer model was used to simulate the movement of truck traffic in downtown Manhattan. This study demonstrated the usefulness of operations research and computer simulation to urban planners.*

## LOWER MANHATTAN MODEL

Strangulating vehicular traffic is a special problem in New York's Manhattan because of the shortage of parking facilities and the high density of traffic. This is particularly true of lower Manhattan, which offers few public parking places and has heavy truck movements for deliveries to buildings. New York had previously been selected by HUD and TAD as a demonstration city for a larger model of accessibility within urban activity centers. TAD and IRT, working with the Mayor's Office of Lower Manhattan Development (OLMD), were charged with examining the congestion problem and making recommendations on the consequences of banning all auto traffic in lower Manhattan. Some other traffic regulation policies, such as enforcing the parking ban, were also to be examined.

The area chosen for OLMD action was Manhattan south of Fulton and Vesey Streets; it is below the Brooklyn Bridge traffic and is bypassed by virtually all traffic for the Brooklyn-Battery Tunnel and the Staten Island Ferry, such traffic instead using the elevated highways bordering lower Manhattan. As a consequence, almost all traffic on the streets of this area is enroute to or from destinations there, and vehicle counts for this traffic can be easily obtained where it enters the area via key north-south streets. The larger model system turned out to be unsuited to the problem, at hand, and a model describing truck movement had to be developed in a very short time.

## OPERATION OF THE MODEL

The Ku-Gilsinn model concerned itself with four types of trucks: panel trucks and small vans similar to automobiles, larger vans, tractor-trailers, and armored trucks. Basic information on the influx of each of these types was obtained from cordon counts at the northern periphery of the area of interest. Other data collected by IRT included tallies of trucks stopping at

*(Continued p. 152)*

# FABRIC FLAMMABILITY TEST ANOMALY RESOLVED

*Fabric on the left half of manikin was adequately treated with fire retardant. The two charred strips on the hemline resulted respectively from 3 and 12 second exposures to flame, the longer char from the longer exposure. A reverse and anomalous behavior occurred with the marginally treated fabric on the right half of manikin. Here the charring or burning has been more severe, and the longer char resulted from the 3-second flame exposure.*

A COMMON TEST FOR THE FLAMMABILITY OF FABRICS is to suspend a strip of the material vertically inside a test chamber and expose it to a small flame impinging on its lower edge. Normal exposure time is 12 seconds, after which the flame is withdrawn. Depending on the characteristics of the fabric, it may continue to burn when the flame is removed or it may self-extinguish. In either case the material is judged according to the char length at the completion of the test.

Tests on fire-retardant treated fabrics at the Bureau and elsewhere revealed that some marginally treated fabrics rated acceptable when exposed to the flame for 12 seconds. The flame would self-extinguish and burning of the material would cease, leaving a short char length. These same fabrics, however, when exposed to the flame for only 3 seconds, continued to burn and thus were rated as unacceptably flammable. The apparent anomaly had potential for grave consequences, because this widely used test method is being considered for testing fabrics under a proposed standard for flammability of children's sleepwear.

R. J. McCarter, of the NBS Office of Flammable Fabrics, undertook an investigation to resolve this anomalous behavior. After numerous tests the accumulated data seemed to indicate that a depletion of oxygen in the plume from the burner flame was responsible for this behavior. Hot gases rising from the burner flame, in which the fabric specimen is immersed, were found to contain only 17 to 19 percent oxygen. At this lowered oxygen concentration, the marginally treated fabric would not burn. However, only 3 seconds exposure to the burner heated this fabric enough to ignite it. If normal air of 21 percent oxygen then surrounded the fabric, it would flame and burn. But in an atmosphere of slightly less oxygen content the fabric would not burn, in spite of the heat supplied by the burner flame.

Nontreated cotton fabrics are sufficiently flammable to easily burn in the 17 to 19 percent oxygen atmosphere of the burner plume. Fully treated fabrics, in turn, are sufficiently retarded that they will not burn in an atmosphere of 21 percent oxygen.

To verify these conclusions, Dr. McCarter devised and conducted various tests. In one series, the oxygen in the atmosphere was reduced by burning a paper towel in the test cabinet before igniting the fabric sample. In another series of tests the oxygen content was reduced by nitrogen dilution. In each case, with 3-second exposures, the marginally treated fabrics passed the test when oxygen concentrations were approximately 2 percent below normal. When normal atmospheres were used, however, the specimens failed; that is, they burned completely after a 3 second exposure to the flame, which points up the criticality of the oxygen content. These results were additionally confirmed by a special apparatus that measured the fabric's "limiting oxygen index" as 19.5 percent oxygen for upward burning.

In another test, an electric heating element, which does not consume oxygen, was used to simulate the burner flame in a normal atmosphere. The results were as expected: the fabric burned completely regardless of whether the heating exposure was for 3 or 12 seconds, or for successive exposures of 3 and 12 seconds.

Finally, a marginally treated fabric was placed in the vertical test cabinet and the gas burner was inserted for 3 seconds and then removed. In this case a modest-sized flame burned up to the top of the fabric specimen. However, if

*(Continued p. 152)*

# PREDICTING TIRE TREAD LIFE

THE NBS OFFICE OF VEHICLE SYSTEMS RESEARCH (OVSR) has been studying how to set up test courses for automobile tires that give realistic appraisals of tire wear. OVSR scientists F. C. Brenner and Akira Kondo laid out two test courses and Francis Barton and Peter Newfeld supervised running several types of tires on both courses in tread wear research for the Department of Transportation's National Highway Traffic Safety Administration (the NHTSA).[1] The courses produced different tread wear data and figures for the expected life for the same tires, but tire rankings obtained from the two courses are much the same.

## MEASURING WEAR OF TIRES IN USE

"How long will they last?" is an important question to a car owner selecting new tires. Needed is a rating system indicating how many miles of use can be expected from each tire offered to him.

Unfortunately there can be no such thing as a single figure for realistically predicting tire life. Tread wear is a function not only of the tire, but also of speed, braking, acceleration, type and condition of road surface, the weather, tire inflation, loading, wheel alinement, tire balance, and the driver's habits, to name some factors.[2]

Because of differences in road and weather conditions, primarily, a tire that lasts 25,000 to 30,000 miles in one region may last only 13,000 or 14,000 miles in another, such as the Atlanta, Ga., area, reported to be one of the country's highest rate-of-wear regions.[3] Nonetheless, data on relative tire life obtained from tests on a standard course would be of great use to the consumers everywhere. Consequently the NHTSA asked the OVSR to obtain the background needed to develop tread wear rating tests.

## TREAD WEAR COURSES

The OVSR first laid out an experimental course to test tentative test protocols and the usefulness for such a test of the runways and roadways of a World War-II jet training base, now belonging to the Texas Transportation Institute. Four types of tires were rotated to all positions on 4 cars running this course. The experimental course consisted of city type driving (stopping, starting, and cornering at low speeds) on the base at Bryan, Texas, travel on conventional asphalt highway over gently rolling terrain, and circuits at high speeds around the airport's runways. This 125-mile course was repeated four times to total 500 miles per shift and two shifts were run per day until 8,000 miles were accumulated. The tires were rotated each day and tread depth was measured between shifts.

The airport experiment was instructive about several things. First: the exact scheme of tire rotation was found to have no effect on total tread wear as long as each tire was used on each wheel position. Second, the projected mileage for the tires run at full load was only about 66% of projected mileage for tires run at 80% of full load. Third, belted tires gave, as expected, higher projected mileage than bias ply tires, but the course produced for all tires far more rapid wear than expected for actual service anywhere in the United States. This was ascribed to the part of the course involving sharp cornering at high speeds.

*(Continued p. 156)*

*Test vehicle rounds a turn on an ex-Air Force base at Bryan, Texas. The test courses included city-type driving on the base, driving on a nearby highway, and high speed (70 mph) driving on the airport runways. This experimentation will help in designing courses for tire tread wear tests.*

# NSRDS NEWS

*The NSRDS was established to make critically evaluated data in the physical sciences available to science and technology on a national basis. The NSRDS is administered and coordinated by the NBS Office of Standard Reference Data.*

## SELECTED VALUES OF CHEMICAL THERMODYNAMIC PROPERTIES

NBS Technical Note 270-5, *Selected Values of Chemical Thermodynamic Properties, Tables for Elements 54 Through 61 in the Standard Order of Arrangement*[1] (55 cents, C13.46:270-5), by D. D. Wagman, W. H. Evans, V. B. Parker, I. Halow, S. M. Bailey, R. H. Schumm and K. L. Churney, is the fifth in a series of Notes containing the tables of numerical values prepared as a revision of NBS Circular 500, *Selected Values of Chemical Thermodynamic Properties.*

This Note contains data for compounds of vanadium, niobium, tantalum, titanium, zirconium, hafnium, scandium, and yttrium. The tables contain values, where known, of enthalpy and Gibbs energy of formation, enthalpy, entropy, and heat capacity at 298.15 K (25°C), and the enthalpy of formation at 0 K, for all inorganic substances and organic molecules containing not more than two carbon atoms. These tables do not cover metal alloys or other solid solutions, fused salts, or substances of undefined chemical composition.

All of the values given in these tables have been calculated from data in original articles using consistent values for all subsidiary and auxiliary quantities. The original data were corrected where possible for differences in energy units, molecular weights, temperature scales, etc. The authors thus have sought to maintain a uniform scale of energies for all the substances in the tables. Further, the tabulated values of the properties of a substance satisfy all the known physical and thermodynamic relationships among these properties. The quantities $\Delta$ Hf°, $\Delta$ Gf°, and S° at 298.15 K satisfy the relation:

$$\Delta Gf^\circ = \Delta Hf^\circ - T\,\Delta Sf^\circ$$

Technical Note 270-5 contains an appendix listing corrections for errors and misprints detected in the previously published Technical Notes 270-3 and 270-4[1] ($1.25 each, C13.46:270-3 and C13.46:270-4), which contain tables of data for compounds of elements numbered 1 through 53 in the standard order of arrangement.

As additional revised tables of Circular 500 are completed, they will be published in the Technical Note 270 series because of the urgent need for the data. After all tables have been revised they will be combined with a description of the evaluation process and a listing of the sources of the data into a single publication that will be a part of the NSRDS series of critically evaluated compilations.

## REFERENCE WORKS FOR THE CHEMICAL KINETICIST

The NBS Chemical Kinetics Information Center has prepared a list of information and data sources, reference works, review articles and monographs on topics in chemical kinetics, which it believes are significant for workers in the field. They are listed below:

### 1. General Purpose and Large Scale Tables.

*a. "Tables of Chemical Kinetics, Homogeneous Reactions"*

(1) NBS Circular 510, xxiv, 732 pp (1951). N. Thon, ed. (National Technical Information Service, Springfield, Va., $10 paper copy, 65 cents microfiche)

(2) Supplement 1 to NBS Circular 510, xiv, 422 pp (1956). C. H. Stauffer, project director (NTIS, $3 paper copy, 65 cents microfiche)

(3) Alphabetical Index, Supplement 2 to NBS Circular 510, iv, 37 pp (1960); Idem (NTIS $3 paper copy, 65 cents microfiche)

(4) NBS Monograph 34, Vol. 1, Supplementary Tables, viii, 459 pp (1961); Idem (U.S. Government Printing Office, Washington, D.C. $2.75)

(5) NBS Monograph 34, Vol. 2, Supplementary Tables, vi, 264 pp (1964); Idem (U.S. Government Printing Office, Washington, D.C. $2)

In these publications selected evaluated rate data are tabulated along with a description of experimental conditions. Reactions in solution are emphasized. The data in these publications were produced during the 1940's and 1950's by the Chemical Kinetics Data Project sponsored by the National Research Council.

*b. "Tables of Bimolecular Gas Phase Reactions," NSRDS-NBS-9 vi, 129 pp (1967). A. F. Trotman-Dickenson and G. S. Milne. (U.S. Government Printing Office, Washington, D.C. $2)*

This publication contains metathetical (group- or atom-transfer) reactions of atoms and radicals with molecules (principally organic); disproportionation reactions of radicals; and disproportionation/recombination ratios. Occasional notes are included on specific data items and, infrequently, estimates of "best values." Literature is cited through 1965 and, in part, 1966.

*c. "Supplementary Tables of Bimolecular Gas Reactions," E. Ratajczak and A. F. Trotman-Dickenson, Publications (Department, UWIST, Cardiff, CFI 3NV, Wales, $4 post free)*

*d. "Reaktionsgeschwindigkeiten," Landolt-Bornstein Tabellen, Zahlenwerte und Funktionen aus Physik-Chemie-Astronomie-Geophysik und Technik, 6th Ed. II Band. Eigenschaften der materie in Ihren Aggregatzustanden, 5, Teil, Bandteil b. Transportphanomene—Kinetik Homogen Gasgleichgewichte," (Springer-Verlag, Berlin) (1968). T. Grewer, L. Kuchler, and H. Zeininger pp 247-336*

This publication contains tables of selected rate constants for gas phase reactions, including metathetical, decomposition, addition and some molecule—molecule reactions.

*e. "Konstanty Skorosti Gazofaznykh Reaktsij Spravochnik" [Handbook of Kinetic Constants of Gaseous Reactions] (Izdatel'stvo "Nauka," Moskva, 1970). V. N. Kondratiev. (Approximately $5 locally)*

Metathetical, combination and dissociation, decomposition isomerization and addition reactions are contained in this publication. Occasional notes on specific data and some recommended values, based on research published up to 1968 are included.

*f. "Kinetic Data on Gas Phase Unimolecular Reactions," NSRDS-NBS-21, xvi, 628 pp (1970). S. W. Benson and H. E. O'Neal (U.S. Government Printing Office, Washington, D.C. $7)*

This publication contains discussions of unimolecular dissociation, isomerization and molecular elimination reactions. Methods for calculating rates and thermodynamic properties, based on group additivities, and over 500 data sheets on specific high pressure unimolecular reactions are included. Rate

data, thermodynamic properties mechanisms and recommended rates are given in most cases. Comparisons are made with calculated rates.

*g. "Bond Dissociation Energies in Simple Molecules," NSRDS-NBS-31 iv, 48 pp (1970). B. de B. Darwent. (U.S. Government Printing Office, Washington, D.C. 55 cents)*

**2. Compilations and Evaluations on Specific Classes of Reactions.**

*a. "An Evaluation of Kinetic Rate Data for Reactions of Neutrals of Atmospheric Interest," Planet. Space Sci.* **15**, *643, 1336 (1967). K. Schofield*

This report deals with evaluation of rate data for the H-O system, reactions of $HO_2$, the N-O system, reactions of ozone, reactions of hydrocarbons (to $C_4$), formaldehyde and acetaldehyde and carbon monoxide with H, O, and OH, and combination-dissociation reactions for diatomic and triatomic molecules.

*b. "High Temperature Reaction Rate Data Series" (issued by the High Temperature Reaction Rate Data Centre, Leeds University, Leeds, England). Data Evaluations.*

(1) D. L. Baulch, D. D. Drysdale, A. C. Lloyd, No. 1 (May 1968)

$$CO + OH \rightleftarrows CO_2 + H \text{ (f,r)}$$
$$CO + OD \rightarrow CO_2 + D$$
$$CO + O \rightarrow CO_2 + h\nu$$
$$CO + O + M \rightleftarrows CO_2 + M \text{ (f,r)}$$
$$CO_2 + O \rightarrow CO + O_2$$

(2) Idem, No. 2 (Nov. 1968)

$$H_2 + O \rightleftarrows H + OH \text{ (f,r)}$$
$$H_2 + OH \rightleftarrows H_2O + H \text{ (f,r)}$$
$$H_2O + O \rightleftarrows OH + OH \text{ (f,r)}$$
$$H_2O + M \rightleftarrows H + OH + M \text{ (f,r)}$$

(3) Idem, No. 3 (April 1969)

$$O_2 + H \rightleftarrows O + OH \text{ (f,r)}$$
$$O_2 + H + M \rightleftarrows HO_2 + M \text{ (f,r)}$$
$$H_2O_2 + H \rightleftarrows H_2 + HO_2 \text{ (f,r)}$$
$$H_2O_2 + H \rightleftarrows H_2O + OH \text{ (f,r)}$$
$$H_2O_2 + OH \rightleftarrows H_2O + HO_2 \text{ (f,r)}$$
$$H_2O_2 + M \rightleftarrows OH + OH + M \text{ (f,r)}$$

(4) D. L. Baulch, D. D. Drysdale, D. G. Horne, and A. C. Lloyd, No. 4 (Dec. 1969)

$$NO + N \rightleftarrows N_2 + O \text{ (f,r)}$$
$$O_2 + N \rightleftarrows NO + O \text{ (f,r)}$$
$$N_2 + O_2 \rightleftarrows NO + NO \text{ (f,r)}$$
$$N_2O + O \rightleftarrows NO + NO \text{ (f,r)}$$
$$NO_2 + N \rightleftarrows NO + NO \text{ (f,r)}$$
$$N + O + M \rightleftarrows NO + M \text{ (f,r)}$$

*c. "Collisional Activation of Gases," The International Encyclopedia of Physical Chemistry and Chemical Physics* **3** *of Topic 19, Gas Kinetics, Pergamon Press (1967). Brian Stevens*

This Monograph includes tables of vibrational relaxation times, and relative collisional deactivation probabilities for diatomic molecules and for polyatomic molecules (inorganic and organic to $C_5$).

*d. "Chemical Reactions in Shock Waves," E. Arnold Ltd. (1964). E. F. Greene and J. P. Toennies*

Monograph that includes tables of data on vibrational relaxation (table 7.7) and rates of reaction (table 7.8).

*e. "Reaction Rate Compilation for the H-O-N System," Gordon and Breach Science Publishers, N.Y., vi, 244 pp (1968). G. S. Bahn*

An annotated listing, by reaction, of rate constant expressions and the experimental conditions under which they were obtained for reactions involving H, $H_2$, O, $O_2$, $O_3$, N, $N_2$, the nitrogen oxides, ammonia, hydrazine (and their fragments).

*f. "A Review of Rate Constants of Selected Reactions of Interest in Re-entry Flow Fields in the Atmosphere," NBS Tech. Note 484 (1969). M. H. Bortner (U.S. Government Printing Office, Washington, D.C. 60 cents)*

This Technical Note contains an evaluation of rates of reactions in the N-O system, including those of neutral species, ions, and ionization processes.

*g. "Reaction Rates for High Temperature Air," Sandia Laboratories Monograph SC-R-66-885 (1966), 57 pp. Mina L. Carnicom. (National Technical Information Service, Springfield, Virginia 22151, $3 hard copy, 65 cents microfiche)*

A monograph containing a compilation of rate data for the N-O system, including ions, and reactions with photons and electrons.

*h. "Reaction Rates for High Temperature Air with Carbon and Sodium Impurities," Sandia Laboratories Monograph SC-R-68-1799 (1968), 152 pp. Mina L. Carnicom (NTIS, $3 hard copy, 65 cents microfiche)*

A compilation of rate data for the N-O system and for reactions of N-O species with C and Na, including reactions of ions and reactions with photons and electrons, make up this monograph.

*i. "Electron Impact Ionization Cross-Section Data for Atoms, Atomic Ions and Diatomic Molecules: I. Experimental Data," Rev. Mod. Phys.* **38**, *1 (1966). L. J. Kieffer and G. H. Dunn*

*j. "Electron Impact Excitation of Atoms," NSRDS-NBS-25 116 pp (1968). B. L. Moiseiwitsch and S. J. Smith (Reprinted from Rev. Mod. Phys.* **40**, *238 (1968).)*

*k. "Radiolytic Yields" in "Tables of Constants and Numerical Data, Selected Constants,"* **13**, *Pergamon Press (1963). M. Haissinsky and M. Magat*

**3. Monographs and Review Articles with High Evaluation or Compilation Content.**

(This list shows the range of material available. It is by no means complete.)

*a. "Hydrogenation of Ethylene on Metallic Catalysts," NSRDS-NBS-13, 62 pp (1968). J. Horiuti and K. Miyahara (U.S. Government Printing Office, Washington, D.C. $1)*

This publication contains an evaluation of data on the reaction kinetics for hydrogenation of ethylene on unsupported transition metals, alloys and some hydrides. Discussion of experimental methods and properties of catalysts as well as literature references including some in 1966 are included.

*b. "Gas Phase Reaction Kinetics of Neutral Oxygen Species," NSRDS-NBS-20, vi, 49 pp (1968). H. S. Johnston (U.S. Government Printing Office, Washington, D.C. 40 cents)*

NSRDS-20 is an evaluation of data on the reactions

$$O_2 + M \rightleftarrows O + O + M \text{ (M} \rightleftarrows O_2, \text{Ar) (f,r)}$$
$$O_3 + M \rightleftarrows O + O_2 + M \text{ (M} \rightleftarrows O_2, O_3, \text{He, Ar, } N_2, \text{CO) (f,r)}$$
$$O + O_3 \rightarrow O_2 + O_2$$
$$O + O_2 \rightarrow O + O_2 \text{ (isotopic exchange).}$$

A set of data was selected (on criteria stated in the monograph), tabulated and used to develop self-consistent rates for the set shown above. It contains many literature references including some in 1967.

*c. An Evaluation of Rate Data for the Reactions of Atomic Oxygen ($O^3P$) with Methane and Ethane," Int. J. Chem. Kinetics* **1**, *527 (1969). J. T. Herron*

*d. "Reactions of Oxygen Atoms" in "Progress in Reaction Kinetics," G. Porter, ed. Pergamon Press* **1**, *p 1 (1961). F. Kaufman*

These reports contain a general discussion of O atom reactions and a tabulation of rates for surface combination, $O + O_2 + M \rightarrow O_3 + M$, and reactions of O atoms with organic molecules.

*e. "The Reactions of Alkyl Radicals" in "Progress in Reaction Kinetics," G. Porter, ed. Pergamon Press* **1**, *p 107 (1971). J. A. Kerr and A. F. Trotman-Dickenson*

Combination, cross-combination, disproportionation, group transfer, and addition reactions are reported.

*f. "A critical review of the Kinetics of the Dissociation-Recombination Reactions of Fluorine and Chlorine," Int. J. Chem. Kinetics* **3**, *39 (1971). A. C. Lloyd*

*g. "The Rate Constants of Halogen Atom Reactions," in "Progress in Reaction Kinetics," G. Porter, ed. Pergamon Press* **2**, *p 3 (1964). G. C. Fettis and J. H. Knox*

*h. "The Kinetics of cis-trans Isomerizations" in "Progress in Reaction Kinetics," G. Porter, ed. Pergamon Press* **2**, *p 167 (1964).*

*i. "The Kinetic Effects of Pressure" in "Progress in Reaction Kinetics,"* **5**, *337-408 (1970). G. Kohnstam*

This publication deals exclusively with reactions in solution. It contains numerous tables and 169 references.

*j. "The Combustion and Oxidation of Acetylene," Chem. Rev.* **70**, *267-293 (1970). A. Williams and D. B. Smith*

266 references are included in this report.

*k. "The Transfer of Energy Between Chemical Species" in "Comprehensive Chemical Kinetics," C. H. Bamford and C. F. H. Tipper, eds. (Elsevier, 1969)* **3**, *Chapter 2. A. B. Callear and J. D. Lambert*

A survey and tabulation of energy transfer cross sections (vibrational, electronic, spin-orbit) are reported.

*l. "Rate Constants of Protolytic Reactions in Aqueous Solution" in "Progress in Reaction Kinetics," G. Porter, ed. Pergamon Press*

**2**, *p 287 (1964). M. Eigen, W. Kruse, G. Maass, and L. de Maeyer*

*m. "Solvolysis in Water," Progress in Physical Organic Chemistry* **4**, *213 (1967). R. E. Robertson*

Hydrolysis rates are reported for halides and sulfonates in water.

*n. "Ion-Molecule Reactions in Radiolysis and Photoionization of Hydrocarbons" in "Progress in Reaction Kinetics,"* **5**, *113-179 (1970). P. Ausloos*

Mass-spectrometric studies of ion-molecule reactions are not included in this report, except for comparison. It contains 182 references.

*o. "The Radiolysis of Hydrocarbons," Radiation Research Reviews* **1**, *1 (1968). G. R. Freeman*

A critical review of the published information about the radiolysis of aliphatic and alicyclic hydrocarbons. Tables of proton, electron and hydride ion affinities along with a discussion of electron attachment processes are included.

*p. "The Radiolysis of Alcohols," Chemical and Biological Actions of Radiations* **14** *(March 1970) M. Haissinsky, ed. G. R. Freeman*

Radiation chemistry of gaseous, liquid, and solid phase alcohols are critically reviewed. Tables of rate constants of ionic and free radical reactions along with information on states of extramolecular electrons are included.

**4. Bibliographies**

*a. "Bibliography of Atomic and Molecular Processes" issued by the Atomic and Molecular Processes Information Center, Oak Ridge National Laboratory, Oak Ridge, Tennessee (National Technical Information Service, Springfield, Va., USA hard copy $3, microfiche 65 cents)*

This bibliography lists pertinent papers and reports published during stated time periods. It is issued semiannually starting with the period July-December 1965.

*b. "Bibliography of Chemical Kinetics and Collision Processes" (IFI/Plenum, New York, 1969). A. R. Hochstim, ed., M. Berman, R. D. Gilardi, N. S. Goel, V. Povard, and G. R. Riegler*

A listing, by reaction, of research on rates of chemical reactions, energy transfer, ionization, ion-molecule, ion-ion, and photolysis processes makes up this bibliography. It contains approximately 2000 entries (one reaction—one paper) based on about 7000 references. Atoms, diatomic and triatomic molecules, $C_1$ and some $C_2$ compounds are emphasized. References are from 1900-1966.

*c. "Bibliography of Ion-Molecule Reaction Rate Data," Joint Institute for Laboratory Astrophysics Information Center (University of Colorado, Boulder, Colorado) Report No. 9 (1969). G. A. Sinnott*

This bibliography contains a listing, by reaction, of papers on ion-molecule reactions, mostly of small ions and molecules of interest for research on atmospheric physics.

*d. "Pulse Radiolysis. A Comprehensive Bibliography" (1960—March 1969), AECL-3524 (1970). H. Greenshields and W. A. Seddon*

**5. Information Analysis Centers**

*a. Atomic Collision Information Center, Joint Institute for Laboratory Astrophysics, University of Colorado, Boulder, Colorado, U.S.A. Dr. L. J. Kieffer, Director*

This Center collects, evaluates, and compiles data on collisions of electrons and photons with ions, atoms, and molecules. Ion-molecule reaction rate data are included. Emphasis is on those processes that are of interest to astrophysicists, aeronomists, and plasma physicists. The Center is part of the U.S. National Standard Reference Data System.

*b. Atomic and Molecular Processes Information Center, Oak Ridge National Laboratory, Oak Ridge, Tennessee. Dr. C. F. Barnett, Director*

This Center collects, evaluates, and compiles data on atomic collision processes and molecular interactions for molecules consisting of less than five or six atoms. It also issues bibliographies covering work reported during stated time spans and sponsors preparation of critical monographs. The Center is supported by the U.S. Atomic Energy Commission and the Office of Standard Reference Data.

*c. Chemical Kinetics Information Center, National Bureau of Standards, Washington, D.C., U.S.A. Dr. David Garvin, Director*

This center collects and indexes published and unpublished reports of research on rates of homogeneous chemical reactions in the gaseous, liquid, and solid phases, photochemistry and inelastic scattering. It is part of the U.S. National Standard Reference Data System.

The center also prepares bibliographies for authors of reviews in the NSRDS critical review series and for the scientific public, both on request and on its own initiative. Evaluations of rate data and tables of data are occasionally issued.

*d. High Temperature Reaction Rate Data Centre, Department of Physical Chemistry, Leeds University, Leeds, England. Dr. D. L. Baulch, Director*

This group evaluates rate data for gas phase reactions that are of importance at high temperature. Results are published as "High Temperature Reaction Rate Data Reports." Nos. 1-4 were issued as of June 1970.

*e. Radiation Chemistry Data Center, Radiation Laboratory, University of Notre Dame, Notre Dame, Indiana, U.S.A. Prof. Milton Burton, Director, Dr. Alberta Ross, Supervisor*

This Data Center collects and indexes published and unpublished reports of research on the elementary chemical processes that occur in systems exposed to ionizing radiation. Rate data are included as well as G-values, spectra of transients, and other parameters describing the interaction of radiation with matter.

The Center also prepares and distributes bibliographies, data sheets, and a weekly accession list. It sponsors the evaluation of data and the preparation of compilations. Current evaluation work is on gaseous ammonia and liquid ethane. Compilations are being prepared on: selected specific rates of reaction in aqueous solution (hydrated electron, hydrogen atom, hydroxyl and perhydroxyl radicals); and reactions of the solvated electron in nonaqueous polar media. The center is part of the U.S. National Standard Reference Data System.

## PERMUTED MATERIALS INDEX

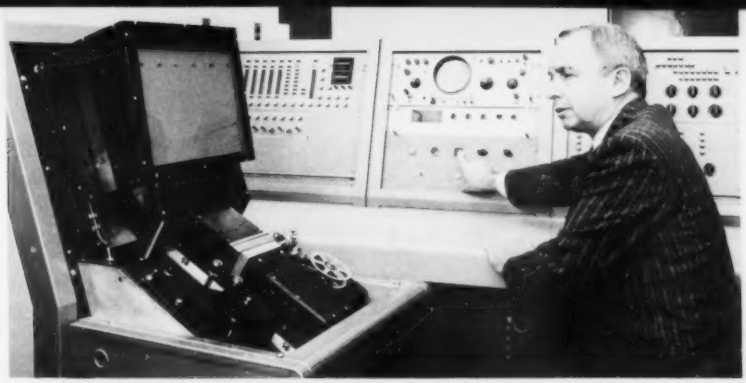
NBS Special Publication 324, *The NBS Alloy Data Center: Permuted Materials Index*[1] ($7, C13.10:324), by G. C. Carter, D. J. Kahan, L. H. Bennett, J. R. Cuthill, and R. C. Dobbin contains literature references to more than 10,000 research papers on physical properties of metals and alloys. The Alloy Data Center, a component of the National Standard Reference Data System has developed an automated system for retrieving papers indexed for its internal use. Papers have been deep indexed and the codes entered in structured format onto magnetic tape. The following information is available on the tape: The first author and journal citation; main experimental technique; physical properties, usually in order of importance in the paper; materials studied (metals and alloys, up to quarternary); material composition (in atomic percent); and temperature at which the work was performed. The magnetic tape can be manipulated in a number of ways. The present index created from the tape contains all NMR Knight shift papers, soft x-ray emission and absorption papers, and a number of papers on topics such as magnetic susceptibilities, specific heats, hyperfine fields, and band structures.

## BIBLIOGRAPHY OF PHOTOABSORPTION CROSS SECTION DATA

NBS-OSRDB-70-4 *Bibliography of Photoabsorption Cross Section Data*[2] (COM-71-00025, microfiche 95 cents, hard copy $4), by Robert D. Hudson and Lee J. Kieffer is the latest publication of the NBS Office of Standard Reference Data series of bibliographies issued by the National Technical Information Service. Only references which report a measured or calculated photoabsorption cross section (relative or normalized) in regions of continuous absorption are included. The bibliography is divided into three sections. The first describes the data in the references by a hierarchy of descriptors; the second section lists the authors, title, and complete reference for the papers cited. The third section consists of an alphabetical author index. The bibliography is current as of March 1, 1970.

[1] Order by SD Catalog Number from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for the price indicated.

[2] Order by PB, AD, TT, or COM number from the National Technical Information Service, Springfield, Va. 22151, for the price indicated.



*Charles Gordon places FOSDIC VI into operation reading oceanographic data from Coast and Geodetic Survey microfilm. Film transport at left advances film under control of logic and control unit (background). Output can be connected on-line to computer or can be recorded for later input.*

*Michael McCabe threads microfilm on FOSDIC VI (**F**ilm **O**ptical **S**ensing **D**evice for **I**nput to **C**omputers), which is being used to read coded oceanographic data from microfilm for the Coast and Geodetic Survey. FOSDIC senses the presence of marks on the microfilm at selected locations and manipulates these data for input to computers.*

# MACHINE READS OCEANOGRAPHIC DATA FOR COMPUTERS

## FOSDIC Scans Microfilm for Data Input

A NEW, FASTER, MORE VERSATILE MODEL OF FOSDIC is making a contribution to data processing and dynamic oceanography. It is the sixth in the series of *F*ilm *O*ptical *S*ensing *D*evices for *I*nput to *C*omputers developed at the Bureau, all of which read visual data from microfilm, select and manipulate them, and prepare them for entry into a computer.

FOSDIC VI was developed by the NBS Institute for Applied Technology and is being used at the NBS Center for Computer Sciences and Technology to read coded oceanographic data from microfilm for the National Ocean Survey (formerly the Coast and Geodetic Survey) of the National Oceanic and Atmospheric Administration. Earlier models of FOSDIC are used by the Bureau of the Census, the Weather Bureau, and the Office of Emergency Planning.

### READING VISUAL DATA FOR COMPUTERS

Reading the black and white data of the printed or written page into a computer without manual processing is a data processing frontier which is now yielding to scientists in Government and industry. Census documents have been read by machine for years and business charge slips printed with name and account number can be sorted and debited to the proper accounts automatically. However, machines for doing this depend on the use of stylized characters.

The series of FOSDICs exemplify the "flying spot" approach to machine reading. Under computer control the entire microfilm frame, or any selected part of it, is swept by a spot of light focussed on it from the face of a cathode-ray tube. The density of the film at selected positions in the scan forms the string of data. The first FOSDIC[1] was produced in 1954 for the Bureau of the Census to sense the positions of marks made on Census forms later microfilmed. All subsequent FOSDICs also accept only microfilm as inputs—FOSDIC II Weather Bureau microfilm of punched cards,[2] FOSDIC III for the 1960 Decennial Census[3] and its Census-built descendant for the 1970 one, FOSDIC IV for the National Weather Records Center,[4] and FOSDIC V for the Office of Emergency Planning.[5]

The electronic systems used to control the scanning beam have developed in complexity and now are entirely transistorized. The mode of operation can be controlled so that the beam seeks reference marks on the microfilm image and configures the scan from this origin to pass over and sense only the points of interest in the tabulation.

Recent models are capable of logical operations, such as rejecting data from frames of documents on which inconsistent responses have been marked.

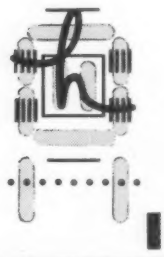
### FOSDIC VI

FOSDIC VI consists of two desktop consoles, one of which (the sensing unit) includes the film transport, the cathode-ray scanning optical system, the viewer screen, and associated circuitry. The other (the logic unit) contains control and logic circuitry, in addition to built-in troubleshooting and operation-monitoring devices. FOSDIC VI can be connected directly to a computer for on-line operation or to a recorder for inscribing its output on magnetic or paper tape for later computer input.

The new FOSDIC is distinguished by its combination of the features of its predecessors, as well as by its expanded ability to analyze graphic input. Searching for recognizable elements of images is facilitated with program-selectable vector and circular motions of the scanning beam. Several modes of output indication are available, such as variable density at different points for contrast in small areas or along paths, all digitized on 16 levels of gray. These capabilities are in addition to those of automatic calibration and pattern recognition, which are typical of the FOSDIC series.

### READING OCEANOGRAPHIC DATA

FOSDIC VI is now being used to read films of oceanographic data collected by the National Ocean Survey, part of the new National Oceanic and Atmospheric Administration. The data—water current direction and velocity measurements—are recorded on 16-mm microfilm by current meters fixed in depth between anchor and buoy. Readings of the compass orientation of the meter body, the angle of the meter current vane, the water velocity, and the inclination angle of the meter body are recorded digitally as dots exposed on the film in parallel channels. Seven channels are devoted to meter heading, seven to vane angle, two to velocity, and one to inclination, in addition to one to timing dots. Sensor readings are repeated at 2 1/2-second intervals for a minute once every ten minutes. When reading them back FOSDIC selects the 15 most representative values for each measurement and averages them to obtain the single value fed to the computer for that minute.



*Foscript is an alphabet (including numerals and punctuation marks) devised in research on machine writing recognition. Each character is written on a grid composed of six rectangular areas; the conventions used in writing Foscript enable it to be read automatically by machine.*

Use of FOSDIC permits maximizing the extraction of data from these films, especially those that require custom tailored scanning. It has enabled the Bureau to expand services to the Survey, at a lower cost then previously available sources of data reduction.

### FOSCRIPT

Each version of FOSDIC has served in its time as a research tool, in addition to performing a task for its sponsor. Several of the FOSDICs have been used in experimentation with machine reading of alphanumeric characters made by man. Still undergoing experimentation at NBS is Foscript, a machine-readable alphabet that received its name from early use with FOSDIC machines. Foscript characters are written with pen or pencil on a grid consisting of a central square with smaller squares outside each corner and a rectangle underneath. The stylized Foscript characters were designed around lowercase alphabetic forms, taking advantage in the code of normal upward or downward strokes, as of the "d" and "p". Most characters are formed by adding extensions to the normal handwritten configurations.

A machine reading Foscript senses the presence of marks in each of the four small squares; then above, below, and inside the larger square; and finally in the rectangle below it. The eight binary elements for each character have been used in forming about 80 unique characters to date, including lowercase characters, numerals, and punctuation marks.

One of the purposes of experimentation with Foscript is to find how long it takes for people to learn constrained writing and how their error rates improve with experience. Tests with this as a goal are now under way; preliminary findings show that some writers reach an error rate of less than 1% within an hour.

Potential uses of Foscript include logging of data and many other applications in which it is desirable to avoid recopying or keypunching data in preparing it for computer input.

[1] FOSDIC—a film optical sensing device for input to computers, Nat. Bur. Stand. (U.S.), Tech. News Bull. **38**, 24-27 (Feb. 1954).

[2] FOSDIC II—reads microfilmed punched cards, Nat. Bur. Stand. (U.S.), Tech. News Bull. **41**, 72-74 (May 1957).

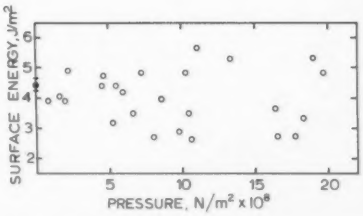
[3] FOSDIC III to assist in 1960 census, Nat. Bur. Stand. (U.S.), Tech. News Bull. **43**, 106-107 (June 1959).

[4] FOSDIC IV reads microfilmed weather data from computer, Nat. Bur. Stand. (U.S.), Tech. News Bull. **51**, 63-65 (April 1967).

[5] Direct communication between man & computer/ACCESS system will process emergency data, Nat. Bur. Stand. (U.S.), Tech. News Bull. **50**, 53-54 (April 1966).

# EFFECT OF PRESSURE ON GLASS FRACTURE

SCIENTISTS AT THE INSTITUTE FOR MATERIALS RESEARCH have investigated the fracture behavior of glass at elevated pressures. In this work by S. M. Wiederhorn and H. Johnson, with help from P. L. M. Heydemann and D. N. Buchalter, experiments were performed to determine the fracture behavior of glass in pressurized inert (liquid) environments and the effect of pressurized water on static fatigue in glass.[1] In both experiments the fracture surface energy of three glass compositions was found to be independent of pressure, suggesting that no change in the fracture mechanism occurs as a result of pressure. Thus for engineering purposes the fracture behavior of glass can be evaluated at atmospheric rather than at high pressures.




*Plot of fracture surface energy as a function of pressure for fused silica glass obtained in a study on the effect of pressure on glass fracture. Results on soda-lime silicate and borosilicate glasses were similar.*

Full utilization of the ocean depths for economic and military purposes depends in large part on having vehicles capable of deep submergence. To attain a depth capability of 20 000 feet necessitates the use of high strength-to-weight materials. Glass is one of the materials being considered for this purpose, but information on its fracture behavior at high pressures has been lacking. In particular, the effect of water under pressure on the mechanical properties of glass should be understood, as water is known to have a deleterious effect on the strength of glass resulting from static fatigue. While a great deal of literature is available to explain this phenomenon, there are no data available on the effect of high-pressure water on static fatigue.

In both the inert environment and water tests, silica, borosilicate, and soda-lime glasses were tested using tensile specimens with dimensions of 3.8 × 1.8 × 0.1 cm, which were previously edge-cracked. Surface energies at fracture were measured at pressures up to 20 kbar (1 bar = $1 \times 10^5$ N/m²) in the inert environments; up to 10 kbar tests were conducted in heptane, and above 10 kbar isopentane was used to avoid freezing.

The specimens were tested in a pressure cell. An opposed action tensile jig was used to apply loads to the specimen and stresses were measured with a four-resistor dc Wheatstone bridge attached to the upper loading arm of the tensile jig. Pressures of the liquids were measured by a manganin gage.

To study the effect of pressurized water on static fatigue in glass, stress time-to-failure determinations were made at pressures close to the freezing point of water (~ 8 kbar). Specimens immersed in water were loaded to some fraction of the critical stress required for fracture in liquid nitrogen to relate the values to those obtained when no chemical action is involved.

The results show that fracture of glass in an inert environment

*(Continued p. 157)*

*Apparatus used in the study to determine the effects of pressure on glass fracture. The glass specimen is inside the pressure cell (held in Dr. Wiederhorn's hand), which is positioned in the load cell.*

# COMPUTER SIMULATION OF AIR TRAFFIC CONTROL SYSTEM

WAYS FOR THE AIR TRAFFIC CONTROL RADAR BEACON SYSTEM to assign transponder codes identifying aircraft in flight have been studied by the Bureau for the Federal Aviation Administration (FAA) of the Department of Transportation. Robert Elbourn, of the NBS Center for Computer Sciences and Technology, and Judith F. Gilsinn, of the NBS Applied Mathematics Division, tried alternative assignment methods by running computer models of the control system in operation.[1] This yielded evaluations of proposed ways in which the present number of codes can be made to serve the volume of aircraft expected until 1990.

## AIR ROUTE TRAFFIC CONTROL

The number of aircraft operating under instrument flight rules (IFR) is expected to triple by 1980, creating growing problems for the already overtaxed air traffic controllers. Their duties are relieved somewhat at present by placement in the aircraft of transponders, small radio transmitters that broadcast an identification number assigned to the aircraft. The plane's crew sets the transponder to the code number assigned by the controller; every time the controller's radar sweeps the plane the transponder is triggered to transmit the plane's identifying code. At present the controller uses the codes to designate classes of aircraft—such as arriving aircraft, departing aircraft, those in different altitude strata, and those having emergencies—and can select for display up to 10 of the classes.

The FAA is in the process of upgrading parts of its air traffic control. In the upgraded system the beacon code can be used to identify individual aircraft instead of classes of them. To do this, no single identification code can be assigned to more than one flight in each Air Route Traffic Control Center (ARTCC), and more identification codes are needed than previously; the system being placed in use accommodates 4096 different codes—from 0000 to 7777 in octal numbers.

*Judith Gilsinn points out to Robert Elbourn a peak in the number of enroute aircraft assigned flight identification numbers by FAA Air Route Traffic Control Centers. Their study of different ways of assigning these identifications will help the FAA in selecting the most efficient method.*

## ASSIGNING CODES

There are 21 ARTCC's in the contiguous United States. A pilot filing a flight plan with the ARTCC in which his flight originates is followed by that ARTCC as far as the boundary to the next control area, where the original ARTCC "hands off" the aircraft to the next ARTCC along the flight plan. The pilot can keep his original code number for his entire flight unless there is already a flight using that number in an ARTCC he enters; in this case he will be reassigned a number by the new control area. The FAA's question is: What is the best way of assigning codes without confusion so that as few as possible have to be reassigned, despite the fact that sometime there may be more aircraft in the air than there are code numbers?

The least complicated coding scheme is for each ARTCC to assign each of its aircraft a randomly chosen number not in use in the ARTCC; if the aircraft's course takes it to another control area it may have to be assigned a new number there. The pilot would then have to reset his transponder as he entered successive control areas. This scheme could be improved by having a separate bank of codes set aside for each ARTCC to assign to flights which do not leave its control area.

A more complicated but smoother running coding scheme uses one master control center,

which assigns the transponder codes for all IFR flights in the United States. All flight plans would be transmitted to this center, which would respond with the code assignment. This center would have to be notified of every handoff and every arrival so that it could update its computerized file of codes in use. It could assign codes so that no one would be required to change his code in flight and no two aircraft in any ARTCC control area would ever have the same code. The master control center minimizes the number of codes required by using the same codes for different flights as long as they do not enter the same control area.

Other assignment plans recognized were: (1) assigning a block of codes to individual airlines, each of which would assign them to its flights, (2) assigning codes according to altitude held and to climbing and descending maneuvers, (3) assigning the same codes for noninterfering areas and courses (north-south flights on west coast, midwest, and east, for example), and (4) fixed code assignments for each air carrier aircraft (for which the fleet size will exceed the number of codes available by the early 1980's).


*Map showing location of 21 Air Route Traffic Control Centers (ARTCC's). The National Bureau of Standards set up computer-run models for the FAA of how these centers could assign coded identification numbers to flights.*

## COMPUTER SIMULATION

Models were constructed for the first two options, assigning codes by the originating and successive ARTCC's and assigning by a master control center. The models contained 21 ARTCC areas identified by the coordinates of about 300 corner points. The models were written in Simscript, a computer language particularly suited for event-oriented simulations.

The simulation was supplied with a magnetic tape containing data from a peak day's IFR traffic in the United States. After preliminary editing, the tape was processed to remove flights outside the contiguous states, retaining 27,692 flights among 1113 airports. Given for each flight were the following data: aircraft identity, type of user (air carrier, general aviation, or military), aircraft type, airspeed, departure airport and time, altitude, and destination.

The model was started at noon Greenwich Mean Time by being loaded with traffic assigned codes at that time and was run for "24 hours," taking 10 minutes of computer time. In the simulation, the aircraft were assigned code numbers 30 minutes before takeoff.

Efficiency of the two options was judged on the basis of the ratio of the number of aircraft served to the number of codes required and on the number of code reassignments required. The center assignment plan required no master center and no intercenter communications, only 816 codes (116 being used by all ARTCC's for intra-area flights), and only one reassignment for every 10 handoffs. The master assignment plan, on the other hand, required a master center and three or four communications with the master center per flight, but used the fewest codes (465) and operated without any in-flight code changes.

Further modelling using the center assignment scheme was directed at reducing the proportion of handoffs requiring reassignment of the code. This was done by assigning enough codes to all of the centers for each to use for flights within the center and by dividing the rest of the codes into banks, each of which was made available to nonconflicting centers. With use of 2800 codes in 4 code banks laid out to avoid repeating the same bank in adjoining centers or along heavily-traveled routes, it was found that only 310 reassignments were required, compared to 507 for single-bank operation.

Further studies planned for this program include the analysis of assignment schemes that can be used during the period of transition, when some terminals are still using the 64-code system but the ARTCC's have changed to the 4096-code system.

[1] Elbourn, R. D., and Gilsinn, Judith F., Simulation of Air Traffic Control Radar Beacon Code Assignment Plans, Nat. Bur. Stand. (U.S.) Tech. Note 568, available from the Superintendent of Documents as SD Catalog No. C13.46:568 (March 1971).


*In the fall of 1965 the Secretary of Commerce established the NBS Center for Computer Sciences and Technology to carry out the Secretary's responsibilities under the Brooks Bill (Public Law 89-306, passed October 30, 1965). The Center provides leadership and coordination for government efforts in the development of voluntary commercial information processing standards, develops recommendations for Federal information processing standards, performs required research and analysis, and provides scientific and technical support and consultative assistance in the field of computers and information processing to Federal agencies. These Notes will cover information-processing standards activities in the Federal Government, particularly those of the Center.*

## GUIDELINES FOR PRESENTING PROPOSALS FOR STANDARDS PROJECTS TO ANSI X3 ARE DEFINED

The X3 Standards Planning and Requirements Committee (SPARC)[1] has recently developed and forwarded to the X3 Chairman (ANSI X3 Committee, Computers and Information Processing) guidelines and instructions for initiating new standards projects in the ADP area. This procedure should be of particular interest to those contemplating new standardization projects at the national level.

Before initiating new work within the X3 Committee, SPARC concluded that certain information is essential to determine the need, feasibility, and expected costs of the work. Also, information is needed to relate the proposed work to other standardization projects currently in process so that duplication of efforts or possible conflicts can be avoided. The outline for presenting proposals and instructions for completing the information needed are provided for the benefit of those desiring to submit proposals for new work to ANSI X3.

Any person, organization, or committee may make a proposal for a new standards project. The originator of a proposal is responsible for providing material relevant to each of the six sections. The Standards Planning and Requirements Committee (SPARC) in consultation with the Standards Steering Committee (SSC) and the International Advisory Committee (IAC) is responsible for the augmentation of these sections toward a possible SPARC recommendation to X3 to establish a standardization project.

When a proposal is received at SPARC, it is reviewed by the committee as a whole or by a study subcommittee. To develop its recommendations, SPARC will determine (1) that the proposal has a rational scope and worthwhile goals, (2) that the benefits alleged are valid, (3) that the proposed standard development is technically feasible, and (4) that the benefits justify the costs. If all these factors are positive, SPARC will recommend the establishment of an X3 Technical Committee to undertake the work. Otherwise, SPARC will recommend that no activity be initiated until the proposal is revised, at which time it will be given another review.

Proposals should be submitted to: ANSI/X3, Attention X3/SPARC Chairman, BEMA Headquarters, 1828 L Street, N.W., Washington, D.C. 20036.

### PROPOSAL INFORMATION

#### 1. Identification

The *title* should be sufficient to identify the subject matter to the uninitiated.

The proposer can, of course, be an organization; however, it is critical to the enterprise to have names of individuals for the purpose of consultation. Although not explicitly specified in the outline, the address with ZIP code, telephone number with area code, TWX, and TELEX for each individual listed is highly desirable.

#### 2. Description

The concepts and terms involved must be carefully and completely defined to avoid the slightest possibility of confusion. The nature of the standard, which might result from the proposed development effort, should be described. This description need not follow the outline or form of a completed American National Standard. However, the functional aspects to be addressed should be covered. In this context the scope to be covered by the proposal should be discussed.

The proposed *scope* is a critical item and must indicate the intended breadth of the proposal. Constraints to the proposal should also be included in the scope. If, for example, the proposal is concerned with disk media and is intended to apply to all manner of disks, the work "all" should appear. If it is meant only for six-high packs, the qualifier

should appear in the scope statement. If there is intent to limit the applicability of the standard to some specific context, then that limitation should be mentioned.

### 3. Benefits

Clearly, what the standard is aimed at accomplishing and the domain for that accomplishment is the key ingredient of any proposal. Something must be gained by the creation of a standard or there is no purpose in considering its development. While the proposer of a standard is not expected to provide an exhaustive analysis of the beneficial effects of his proposal, he is remiss if he cannot make at least a *prima facie* case for the value of implementing his suggestions. There seem to be four essentially different categories of potential benefits to be obtained from standardization: intrinsic, interchange, educational, and economic. Not every standard will possess benefits of each kind, but all sensible standards will have at least one of the categories to its credit.

*Intrinsic benefits* of a standard are found when consideration is limited to the interpal operations of a single installation. Certain kinds of standards make it both easier and cheaper for the user to compare various sources of supply such as punched cards, paper, magnetic tapes, and the like. These same standards reduce incompatibility problems between different generations of machines, whether from one or several suppliers.

*Interchange benefits* are the most obvious virture of many standards; indeed, they are the sole reason for development of a large number of information processing standards. If two installations employ the same media and the same code, interchange of data is simple, even, at times, trivial. Otherwise it can often be unnecessarily cumbersome. Standards for programming languages and related software concepts help the cause of program interchange. In fact, sometimes the value of a standard in this area can be great enough to outweigh clear disadvantages in other areas.

*Educational benefits* are sometimes overlooked. The standard programming languages have a clear virtue in this area, as do most documentation standards. Almost every reasonable standard has some educational value just by its existence. It may on occasion be slightly harder to learn a standard way of doing something than to learn some nonstandard alternative, but it will rarely be easier to learn several nonstandard methods as opposed to a single standard.

*Economic benefits* of implementing a particular standards proposal should be discussed in specific terms. Wherever possible, estimated dollar benefits should be included. Standards should establish economically feasible practices that would otherwise be out of the question because of cost. In short, the real justification for almost any standard is economic; benefits can be measured against cost only where dollar figures are given. The importance of this aspect of the proposal cannot be overemphasized.

### 4. Technical Feasibility

It is useless to propose an unimplementable standard. Hecne, section 4 of the Outline calls for a discussion of the technical feasibility of the proposal. *Existing practice* and the *state of the art* can clearly determine whether or not a standard can really be developed in the area in question. This is not always as obvious as it might seem from consideration of the standards in information processing published to date. Consider, for example, the proposal, which has been made on several occasions informally, to develop a formal language for describing programming languages. For such a proposal, questions immediately arise as to the feasibility of actually doing this in sufficient generality to usefully describe all existing programming languages, much less to deal with potential inventions. Desire is not sufficient; the wherewithall to accomplish the task must also be at hand. It is vital to consideration of any standard proposal that this feasibility be both demonstrated and documented.

The *development* of any standard will *cost* money. The process of agreeing to a standard is expensive enough even if the document containing the standard already exists. If it must be developed, a great deal of expensive time and talent must be devoted to the effort. Also more is involved than time at meetings. Committee members have homework to do if the committee meetings are to have any value and in many cases there are a number of people behind the scenes doing a great deal of work toward the development of a satisfactory standard. These costs often are heavily dependent on the amount of difference that exists between concerned organizations, and the effects of such differences must be figured into estimating the cost of development of the standard.

The proposer should have some idea of how to go about the job of developing the particular standard and the *resources* that can be applied. Preferably, alternative approaches should be considered and presented. SPARC and its Study Committee might well amplify and extend this part of the proposal. Source of expertise and information on the subject are vital toward the establishment of a Technical Committee. The identification of individual experts, organizations with known competence in the area, and relevant documentation are very important.

### 5. Implementation Feasibility

Development of a standards document is one thing and subsequent user and supplier implementation and conformance are another. To be of practical value the standard must be implementable by suppliers and useful to users. This section must contain a discussion of this aspect of the proposal. Will it be clear what should be done and how to do it? Often, even the best efforts at standardization leave ambiguous the question of how to measure or determine conformance. Will it be possible and practical to do what the standard suggests and to use what the standard recommends without severe functional impositions on both supplier and user?

Some consideration of the possible compatibility conflicts with anticipated developments resulting from advancing technology is also necessary. No need exists for a standard that will put technology in a box from which it can escape only by revolution.

Even though it may be possible to develop a standard, this standard will be of no value unless it is put to use. Thus, the question of compatibility with existing standards and practices is a critical element in determining the feasibility of undertaking a development effort. Compatibility is not, of course, a *sine qua non* for determining to undertake a standards effort, but the effects of any incompatibilities generated must be carefully examined in advance.

The *costs of conversion* to a standard may be the critical cost item upon which the case may stand or fail. It is necessary to know whether the standard can be implemented at an acceptable cost. Also, there may be some *costs associated with the day-to-day use* of the standard. A general tape label takes up space on the tape and thus time to pass over. If the general label is not required in all applications there is some overhead unnecessary in the specific situation. While the price may well be worth paying, it should be known for sensible evaluation.

### 6. Maintenance

The proposer should attempt to estimate the *frequency and extent of probable changes* to the standard resulting from experience gained and flaws discovered in its use. For example, programming language standards, at least the way they are written now, invariably have ambiguities that do not show up until compiler implementations are underway. Someone then must analyze and deal with these ambiguities. Likewise, a standard that calls for a registry of codes will require evaluation and revisions.

*Standards can be dynamic. There are often requirement for further amplification, modernization, updating, and even changes to standards. ANSI procedures require as a minimum a formal review of each standard at least once every five years.*

Thus, another important element of the cost equation is the continuing *cost of main-*

*taining* the standard after adoption. This can be high in some cases and an important factor in the practicality of initiation of a standards development.

Clearly then it is desirable for the proposer to identify *resources* of organizations and individuals that have a professional interest in maintaining and updating the standard as deemed necessary. *There also should be an identification of work already done on the subject in the form of a bibliography of pertinent publications for use as an information resource for the project.*

**OUTLINE FOR PRESENTING A PROPOSAL FOR AN ANSI/X3 STANDARDS PROJECT**

1. Identification of Proposed Standards Project
   - .1 Title:
   - .2 Project proposed by:
   - .3 Date of proposal:
2. Description of Proposed Standards Project
   - .1 Nature of the standard which might result:
   - .2 Scope and limitations upon its intended use:
3. Expected Benefits
   - .1 Intrinsic:
   - .2 Interchange:
   - .3 Educational:
   - .4 Economics:
4. Feasibility of Development
   - .1 State of the art:
   - .2 Cost considerations:
   - .3 Resources:
5. Feasibility of Implementation
   - .1 Supplier conformance considerations:
   - .2 User operational considerations:
   - .3 Cost considerations:
6. Maintenance Considerations
   - .1 Frequency and extent of probable changes:
   - .2 Cost:
   - .3 Resources:

**FEDERAL INFORMATION PROCESSING STANDARDS ISSUED**

| | |
|---|---|
| FIPS PUB 0 | General Description of the Federal Information Processing Standards Register |
| FIPS PUB 1 | Code for Information Interchange (FIPS 1) |
| FIPS PUB 2 | Perforated Tape Code for Information Interchange (FIPS 2) |
| FIPS PUB 3 | Recorded Magnetic Tape for Information Interchange (FIPS 3) |
| FIPS PUB 4 | Calendar Date (FIPS 4) |
| FIPS PUB 5-1 | States and Outlying Areas of the United States (FIPS 5-1) (Revision of FIPS PUB 5 and FIPS 5) |
| FIPS PUB 6-1 | Counties and County Equivalents of the States of the United States (FIPS 6-1)(Revision of FIPS PUB 6 and FIPS 6) |
| FIPS PUB 7 | Implementation of the Code for Information Interchange and Related Media Standards (Supplement to FIPS 1, 2, and 3) |
| FIPS PUB 8 | Metropolitan Statistical Areas (FIPS 8) |
| FIPS PUB 9 | Congressional Districts of the United States (FIPS 9) |
| FIPS PUB 10 | Countries, Dependencies and Areas of Special Sovereignty (FIPS 10) |
| FIPS PUB 11 | Vocabularly for Information Processing (FIPS 11) |

[1] See Reorganization of ANSI Standards Committee X3, FIPS Notes, Nat. Bur. Stand. (U.S.), Tech. News Bull. **54** (6) 100-102 (May 1970).

## ROAMS *continued*

selected destinations in lower Manhattan.

The major task of the three stages of the computation for the model was to obtain an estimate, consistent with observed data, of the number of trucks of each type from each point of entry stopping at each destination. This determination was made in a plausible but non-definitve manner, because the types of data that would have permitted definitive answers were lacking.

The model was run on large scale computers, primarily those at NBS and at New York University. The findings were that some benefits could be expected from banning private automotive traffic in the area considered, but that inadequacy of building loading docks is the significant factor in the problem. Most important is the demonstration of the potential of mathematical analysis as a tool for urban decision-makers.

In part as a result of the findings presented to OLMD, a plan to ban all auto traffic in lower Manhattan effective January 1971 was aborted. It is significant that systems analysis techniques could be brought to bear on this politically and socially volatile issue.

## ANOMALY *continued*

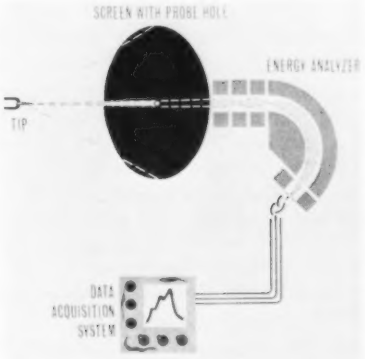
the burner was reinserted under the fabric specimen at any time during its burning, the flame on the fabric was extinguished instantly, as if sprayed by a carbon dioxide extinguisher. This action is so fast that it appears implausible that any action other than "gas blanketing" could be involved.

Various alternatives are available to modify the vertical test procedures in view of this information. Most fabrics subjected to the test will be ignited by a 3-second burner exposure. Of the few fabrics that may require a longer ignition interval, in the 3 to 12 second range, the test results appear to be little affected when the burner is applied for 3 seconds, withdrawn, and then reapplied to the same specimen for 12 seconds. This phenomenon is being studied further, and a suitable modification is being considered for the vertical test procedure.

# SURFACE STATES OF ELECTRONS IN METALS

## NBS Experiment Verifies Theory

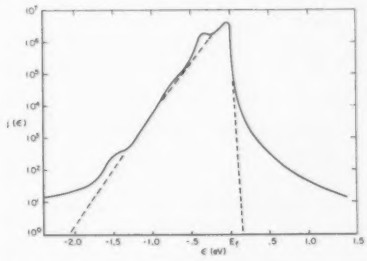
THE TERMINATION OF A SOLID AT THE SURFACE creates the potential for unique localized electronic states. Theoretical predictions of the existence of these localized electronic states at metal surfaces have been verified experimentally[1] by E. W. Plummer and J. W. Gadzuk of the NBS Optical Physics Division, using a Simpson-Kuyatt spherical deflection energy analyzer specially adapted to a field emission source by C. E. Kuyatt. This new analyzer has extended the dynamic range of field emission energy distributions by at least a factor of three, revealing many new surface effects. This technique may have future applications in analyzing surface chemical reactions such as the initial stages of corrosion or simple catalytic processes.




*Schematic diagram of apparatus used to analyze the energy distribution of electrons being field emitted from the metal tip of the emitter at left, through a probe hole in the fluorescent screen, to the analyzer and detector.*

### SURFACE STATES

The electronic states at a solid surface may differ considerably from those deep within the bulk. From a simplified point of view this difference occurs because the presence of the surface creates new boundary conditions on the allowed behavior of the electrons. Two consequences of this boundary are immediately obvious: (1) There is a large variation in the spatial distribution of electrons through the surface region; (2) the distribution of electrons in energy will be different in the surface region relative to the bulk. Any electronic states localized spatially near the surface resulting from the presence of the boundary are commonly referred to as surface states or surface resonances.




*Surface state electrons from the (100) plane of tungsten at 78K are studied at NBS. The surface states are observed as secondary peaks on the left side of the total energy distribution curve (electron count rate per unit energy versus energy) for tungsten which is plotted both experimentally (solid line) and theoretically (dotted line).*

The prediction of these localized electronic surface states for transition metals has been verified for single crystal faces of tungsten. Structures in the field emission energy distribution, 0.35 eV and 1.5 eV below the fermi energy on the (100) plane of tungsten, have been observed and correlated with position of spin-orbit split bands in this direction. It is at these splittings that the possibility for a surface state exists.

### EXPERIMENT

In these measurements a fine tungsten wire is etched to a point of about 1000 Å radius, and used as the emitter of electrons in electron field emission microscopy. A field of nearly 30 million volts per centimeter is achieved at the surface of the emitter by applying a few thousand volts to a fluorescent screen, perpendicular to the point. At such a high field the electrons tunnel elastically from within the metal tip into the vacuum to produce a stereographic projection of the nearly hemispherical end cap of the tip on the screen. Contrast in the screen's image is due to crystallographic variations in the electronic work function—the minimum energy required for an electron to escape from a given surface.

The plane to be studied is positioned over a small hole in the screen (probe hole) and the electrons passing through the probe hole are energy analyzed. The analyzer is composed of a set of retarding lenses, designed by C. E. Kuyatt, and a 135° spherical deflection analyzer of the Simpson-Kuyatt type. It is capable of current measurements over eight orders of magnitude at a resolution of at least 0.020 eV.

[1] For further details, see Plummer, E. W., and Gadzuk, J. W., Surface states on tungsten, Phys. Rev. Letters **25,** 1493 (1970).

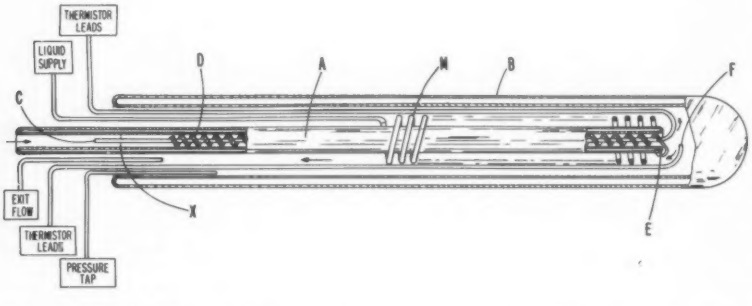
# HEATED-AIR ADIABATIC SATURATION PSYCHROMETER

A PORTABLE SELF-CONTAINED HEATED-AIR ADIABATIC SATURATION PSYCHROMETER[1] useful as either a field or laboratory instrument has been developed by L. Greenspan of the Institute for Basic Standards. The instrument, developed under sponsorship of the Aerospace Instrumentation Laboratory, Air Force Cambridge Research Laboratories, measures the humidity of air in the range from 0 to 50 grams of water vapor per kilogram of dry air over an ambient temperature range of −5 to 40 °C. In addition to air humidity measurements for meteorological, air conditioning, and industrial applications, the psychrometer is also capable of determining vapor content of other gases.

This psychrometer is an instrument whose performance is specified by means of an equation derived from classical thermodynamics. The instrument utilizes a steady-flow adiabatic isobaric saturation process, whereas other psychrometers, even under steady-state conditions, are open systems undergoing a nonequilibrium process that cannot be described completely by classical thermodynamics.

The instrument operates on a conservation of enthalpies princi-

*The portable self-contained heated-air adiabatic saturation psychrometer.*




*Schematic drawing of the adiabatic saturation psychrometer. The portable self-contained heated-air psychrometer measures humidity of air in the range from 0 to 50 grams of water vapor per kilogram of dry air over an ambient temperature range from −5 to 40 °C. Labeled components are: saturator tube (A), Dewar flask (B), thermistor (C), locator disk (X), glass fiber wicking (D), water feed tube (E), thermistor (F), and heat exchanger (M).*

ple.* The vapor-gas mixture to be measured is adiabatically saturated at approximately constant pressure. After reaching steady state, the entrance and exit temperatures and the exit pressures are measured. From the pressure and two temperatures the humidity of the initial mixture can be calculated. The entrance and exit temperatures are analogous to dry-bulb and wet-bulb temperatures in conventional psychrometry.

A feature of the device is that the entrance gas is heated. This does not affect the adiabatic isobaric principle since the entrance gas temperature is measured after the heating and it is this elevated temperature that enters into the computation. The use of heated gas extends the range of measurements since it ensures exit temperatures above freezing regardless of the conditions of temperature and humidity of the test gas prior to heating.

The main component of the instrument is a vacuum-jacketed glass saturator tube surrounded by a glass Dewar flask. A thermistor is positioned within the saturator tube for measuring the temperature of the entrance gas. A glass fiber wick, maintained in a moist condition, serves to saturate the gas. Another

*(Continued p. 156)*

*Symbolically the conservation of enthalpies is expressed:

$$h(P,T,r)+(r_w-r)\,h'_w(P,T_w)=h(P,T_w,r_w)$$

where $h(P,T,r)$ is the enthalpy per gram of dry gas of the initial vapor-gas mixture; $h(P,T_w,r_w)$ is the enthalpy per gram of dry gas of the final vapor-gas mixture; $h'_w(P,T_w)$ is the enthalpy per gram of the water; $r$ is the mixing ratio of the initial vapor-gas mixture in grams of vapor per gram of associated dry gas; and $r_w$ is the mixing ratio of the final (saturated) vapor-gas mixture in grams of vapor per gram of associated dry gas. As $r_w$ is a function of P and $T_w$, $r$ can be determined with knowledge of P, T, and $T_w$.

*NBS theorists are assisting in studies of the electron-atmosphere interactions responsible for auroral displays such as this one observed in the midnight sky near College, Alaska. Photo Courtesy of the University of Alaska.*

# THE ELECTRON'S ROLE IN AURORAL DISPLAYS

SPACE EXPLORATION HAS EMPHASIZED THE NEED for a basic understanding of charged-particle interactions in the upper atmosphere. The study of auroral displays accessible to observation from the ground, provides valuable information about the interactions of electrons with atmospheric constituents. Martin J. Berger and Stephen M. Seltzer, theoretical physicists at NBS, working with Kaichi Maeda of the National Aeronautics and Space Administration, used the Monte Carlo method to determine the spatial pattern of energy deposition by auroral electrons in the upper atmosphere, in a project supported by NASA.[1]

Physicists believe that auroral displays are caused by the emission of light from nitrogen molecules excited by electrons that precipitate into the atmosphere. The amount of emitted light is roughly proportional to the amount of electron energy absorbed in the atmosphere at a given location. Therefore the calculated energy deposition patterns yield auroral luminosity patterns.

The immediate motivation for the present work was provided by the need to estimate luminosity patterns in an experiment in which an artificial aurora was created.[2,3] In this experiment an accelerator carried on board an Aerobee 350 rocket injected a beam of 8.7-keV electrons down into the atmosphere along magnetic field lines from a height of 260 km. Prior to the experiment the theorists used the Monte Carlo method to compute the expected light intensity as a function of height in the atmosphere and of the radial distance from the magnetic field line.

The Monte Carlo calculation is an unusual one in that it takes into account not only the elastic and inelastic collisions of electrons with atomic nuclei and orbital electrons, but also the deflection of the electrons by the geomagnetic field. At the top of the atmosphere magnetic deflection is the dominant phenomenon, whereas at lower altitudes multiple coulomb scattering predominates. The computations served to trace the transition from one regime to the other.

In the artificial aurora experiment the luminosity pattern was observed to extend down to a height of 106-104 km and to have a radial width of $150 \pm 30$m, which is consistent with the predicted values. In fact, the calculated results, available in advance, were of help in locating and recording the auroral patterns.

Calculations of spatial luminosity patterns were also carried out for applications to natural auroral displays, assuming electrons with energies between 2 keV and 20 keV to be incident onto the atmosphere with a pitch-angle distribution isotropic over the downward hemi-

sphere. For an electron energy of 10 keV, the maximum radial diameter of the luminosity pattern was found to occur at an altitude of 110 km and to have a magnitude of 140 metres. Thus the calculation of the combined effect of multiple scattering and magnetic deflection provides a partial explanation for the not uncommon occurrence of very narrow (curtain-like) auroral luminosity patterns.

Related work based on the same Monte Carlo method is now in progress at the National Bureau of Standards on the backscattering of auroral electrons from the atmosphere, the electron flux spectrum at various heights in the atmosphere, and the production of bremsstrahlung by auroral electrons.

[1] For further details, see Berger, M. J., Seltzer, S. M., and Maeda, K., Energy deposition by auroral electrons in the atmosphere, J. Atmos. Terrestrial Phys. **32,** 1015-1045 (1970).

[2] Hess, W. N., Science **164,** 1512 (1969).

[3] Davis, T. N., Hallinan, T. J., Trichel, M. C., and Hess, W. N., Ground-Based Optical Observations of Artificial Auroras Generated With a Rocket Borne Electron Accelerator, Geophysical Institute of the University of Alaska report number UAG R-210; NASA Scientific Report Contract NSR-02-001-035 (April 1970).

## TIRE TREADS *continued*

Further experimentation was undertaken to determine if individual brands and types of tires would be similarly rated by tests on two different types of course. It was also desired to determine if projected mileages or rankings obtained by running a 16,000-mile course would differ significantly from those from an 8,000-mile course.

For the further experimentation the Bryan course was rearranged to provide more road miles and less sharp cornering. Each circuit was still 125 miles and four of them equaled 500 miles per shift; however, only one shift was run a day. Mileages of projected tire life were computed at 8,000 actual miles.

A second course was laid out, running from San Antonio to beyond Leakey, Texas, and doubling back on some segments for a circuit length of 500 miles. Part of the mileage was over four lane highways through rolling country, but much of it was over hilly, rural roads with steep grades and curves. At least four types of asphalt were found on this course. Mileages of tire life were projected at 8,000 and 16,000 actual miles.

### FINDINGS

The modified Bryan course produced projected mileages that were much more compatible with tire lives common in the United States, averaging 24,000 miles. Tread life projections obtained from running the San Antonio course twice for 8,000 miles each were generally similar (averaging 26,633 and 27,974 miles) and both were greater than the Bryan figures, except for three of the six radial ply tires tested. The researchers concluded that combining the two 8,000-mile San Antonio tests into one 16,000-mile test offered no advantages.

The second set of San Antonio data had been obtained in considerably drier weather than the first, but the differences between the two sets of figures showed no commonality. However, when the data were converted into rankings (from 1 to 18), seven tires received the same rank from the Bryan data and one or both sets of San Antonio data. The rankings in the several data groups were not significantly different.

The OVSR researchers favor using ranking over mileage projections, both because this enables them to make more useful comparisons and because only relative values are valid for the country in general.

The researchers agree that assembling a course from diverse components is essential for obtaining tire appraisals that have nationwide meaning. It is possible for a tire to deliver superior mileage under specific conditions—as for use on hilly roads with severe curves—but ranking with other tires would indicate its suitability for the country as a whole.

[1] Brenner, F. C., and Kondo, A., Research for a uniform quality grading system for tires/IV. Tread wear, Rubber Chem. and Tech. (Mar. 1971).

[2] Moyer, R. A., Tire Wear and Tire Failures on Various Road Surfaces, 44 pp (June 1943), available from National Technical Information Service, Springfield, Va. 22151 as Accession No. PB 191039, and Moyer, R. A., and Tesdall, G. L., Tire Wear and Cost on Selected Roadway Surfaces (1945), available from NTIS as Accession No. PB 191040.

[3] B. F. Goodrich, Map of tire mileage—660 2-ply—by zone, Modern Tire Dealer **51,** No. 6, 130 (Jan. 1970).

## HEATED-AIR *continued*

thermistor, located beyond the outlet end of the saturator tube, measures the exit gas temperature. A helical stainless steel capillary tube surrounds the saturator tube for maintaining the temperature of the water moistening the wick at the same temperature as the exit gas/vapor mixture. Pressure is measured by means of a differential pressure gage that is connected to the psychrometer by a plastic tube.

The psychrometer has been compared with the highly accurate NBS humidity generator[2] over a range of mixing ratios from 2.5 to 19 grams of water vapor per kilogram of dry air. The mean difference between the measured value and the generated value over this range was 0.050. In terms of partial pressure of vapor, the mean difference was 0.078 millibar and in terms of dewpoint temperature the mean difference was 0.088 °C.

[1] For complete details, see Greenspan, L., Heated-air adiabatic saturation psychrometer, J. Res. Nat. Bur. Stand. (U.S.) **75C** (2) (April-June 1971).

[2] Wexler, A. and Daniels, R. D., Jr., Pressure humidity apparatus, J. Res. Nat. Bur. Stand. **48,** 269 (1952).

# STANDARDS AND CALIBRATION

## STANDARD FREQUENCY AND TIME BROADCASTS

High-frequency radio stations WWV (Fort Collins, Colo.) and WWVH (Maui, Hawaii) broadcast time signals on the Coordinated Universal Time (UTC) system as coordinated by the Bureau International de l'Heure (BIH), Paris, France. The NBS time scale, UTC(NBS), and the U.S. Naval Observatory time scale, UTC(USNO), are jointly coordinated to within $\pm 5$ microseconds. The UTC pulses occur at intervals that are longer than one coordinated second by 300 parts in $10^{10}$ during 1971, due to an offset in carrier frequency coordinated by BIH. To maintain the UTC scales in close agreement with the astronomers' time, UT2, phase adjustments are made at 0000 hours Greenwich Mean Time (GMT) on the first day of a month as announced by BIH. *There will be no adjustment made on July 1, 1971.*

The low-frequency radio station WWVB (Fort Collins, Colo.) broadcasts seconds pulses without offset to make available to users the standard of frequency so that absolute frequency comparisons may be made directly, following the Stepped Atomic Time (SAT) system. Step time adjustments of 200 ms are made at 0000 hours GMT on the first day of a month when necessary. BIH announces when such adjustments should be made in the scale to maintain the seconds pulses within about 100 ms of UT2. *There will be an adjustment made on July 1, 1971. The seconds pulses emitted from WWVB will be retarded 200 ms.*

NBS obtains daily UT2 information from forecasts of extrapolated UT2 clock readings provided by the U.S. Naval Observatory with whom NBS maintains close cooperation.

## Roy Trowbridge, ANSI President

Roy P. Trowbridge, director of engineering standards, General Motors Corporate Engineering Staff, is the current president of the American National Standards Institute. Mr. Trowbridge, whose term as president began Jan. 1, 1971, succeeds Francis LaQue, who is now president of the International Organization for Standardization (ISO).

ANSI serves as the coordinating agency and clearinghouse for voluntary standardization in the United States. ANSI not only prepares standards through the efforts of its own Committees, but also promulgates standards developed by other organizations. In addition, ANSI represents the United States in the international standardization work of ISO and the International Electrotechnical Commission.

NBS is involved in ANSI activities in many ways. Many Bureau staff members serve on ANSI standards-developing committees, NBS Director Lewis M. Branscomb is on the ANSI Board of Directors, and NBS was involved, in 1909, in the founding of the American Engineering Standards Committee, the predecessor to ANSI.

## PRESSURE *continued*

remains essentially a brittle process to pressures of 20 kbar. It was also evident that water under pressure does not affect the time dependent strength behavior usually observed in glass. It is thought that this null effect results from compensating mechanisms, in which the increase in fracture resistance arising from a positive activation volume for the stress corrosion reaction is balanced by a decrease in fracture resistance due to increased hydroxyl ion concentration at the crack tip. The brittle behavior of glass thus differs from plastics and metals that become stronger and more ductile with increasing pressure.

[1] Wiederhorn, S. M., and Johnson, H., Effect of pressure on the fracture of glass, J. Appl. Phys. **42**, No. 2, 681-684 (Feb. 1971).

# CONFERENCE & PUBLICATION *Briefs*

## 56th NATIONAL CONFERENCE ON WEIGHTS AND MEASURES

The 56th National Conference on Weights and Measures will be held at the Shoreham Hotel, Washington, D.C., July 12-16, 1971. Secretary of Commerce Maurice H. Stans will keynote the Conference, to which more than 500 delegates are expected. The theme of this year's meeting is "Progress Through Understanding and Cooperation."

Founded and sponsored by the Bureau, the National Conference on Weights and Measures is an organization of weights and measures enforcement officials of the states, counties, and cities of the United States. The annual meeting of the Conference brings together these enforcement officials; other government officials; representatives of business, industry, trade associations; and consumer organizations for the purpose of exchanging information on subjects that relate to the field of weights and measures administration.

The programs of the National Conference on Weights and Measures and its committees explore the broad area of this economically important segment of governmental regulatory service. The Conference develops and adopts model laws and regulations, technical codes for weighing and measuring devices used in commerce, test methods and enforcement procedures, and administrative guidelines that serve as recommendations to enforcement officials in the interest of promoting uniformity of requirements and methods among weights and measures jurisdictions.

A major objective of the National Conference on Weights and Measures is to foster understanding and cooperation among weights and measures officials and between them and all industrial, business, and consumer interests.

This year's program features many distinguished and highly qualified speakers who will make presentations on a variety of important topics that will be generally keyed to the Conference theme. Again this year, open-forum sessions will be held covering three general areas of concern to weights and measures officials—management, merchandising, and measurement. Each will include presentations on selected topics, followed by a question-and-answer period.

An "Industry Display of New Designs, Applications, and Practices" has been added as an experimental feature in this year's program. On July 14, manufacturers, packagers, and other industry representatives will display equipment and material of interest to the delegates.

A registration fee of $25 has been established by the Executive Committee for the 56th Conference. The proceedings of the Conference, to be published by NBS, will include all talks, reports, discussions, and other information.

Further information may be obtained by writing to:

H. F. Wollin
Executive Secretary
National Conference on Weights and Measures
National Bureau of Standards
Washington, D.C. 20234

## INNOVATIVE METROLOGY—KEY TO PROGRESS

"Innovative Metrology—Key to Progress," *Proceedings of the 1970 Standards Laboratory Conference*, H. L. Mason, editor, NBS Special Publication 335, (132 pages, $1.50), SD Catalog No. C13.10:335, contains the 25 papers and addresses presented at the latest biennial meeting of the National Conference of Standards Laboratories (NCSL). The first of five technical sessions dealt with new radiological measurement techniques, automated test consoles, computer-controlled systems, and cost-reduction-methods of bolometer mount calibrations. Session 2, on laboratory management and operations reports, includes papers on recent ideas and results of interlaboratory comparisons. Four methods of dealing with the perennial problem of optimizing calibration intervals are examined in Session 3; while Session 4 describes new techniques in laboratory measurement-auditing methods, "visibility and control," monitoring and improving instrument reliability, and encouragement of innovation. The last session, on international developments, among other things gives an account of electrical standards and traceability in Japan, a report on the measurement of fundamental atomic constants (at the National Physical Laboratory, England) that can serve as a check on voltage standards, and a report from Canada on the impact of advanced electronic technology on measurements.

# PUBLICATIONS of the National Bureau of Standards*

## PERIODICALS

*Technical News Bulletin*, Annual Subscription: Domestic, $3; foreign, $4. Single copy price 30 cents. Available on a 1-, 2-, or 3-year subscription basis. SD Catalog No. C13.13:54.

*Journal of Research of the National Bureau of Standards*

*Section A. Physics and Chemistry.* Issued six times a year. Annual subscription: Domestic, $9.50; foreign, $11.75. Single copy price varies. SD Catalog No. C13.22/sec.A:74.

*Section B. Mathematical Sciences.* Issued quarterly. Annual subscription: Domestic, $5; foreign, $6.25. Single copy, $1.25. SD Catalog No. C13.22/sec.B:74.

*Section C. Engineering and Instrumentation.* Issued quarterly. Annual subscription: Domestic, $5; foreign, $6.25. Single copy. $1.25. SD Catalog No. C13.22/sec.C:74.

## OTHER NBS PUBLICATIONS

Baker, D. V., Editor, 1970 Technical Highlights of the National Bureau of Standards, Annual Report, Fiscal Year 1970, Nat. Bur. Stand. (U.S.), Spec. Publ. 340, 258 pages (Feb. 1971) $1.50, SD Catalog No. C13.10:340.

Breden, L. H., Technical Standards Coordinator, Plastic heat-shrinkable film, Nat. Bur. Stand. (U.S.), Prod. Stand. 29-70, 16 pages (Jan. 1971) 15 cents, SD Catalog No. C13.20/2:29-70.

Breden, L. H., Technical Standards Coordinator, Polystyrene plastic sheet, Nat. Bur. Stand. (U.S.), Prod. Stand. 31-70, 14 pages (Jan. 1971) 15 cents, SD Catalog No. C13.20/2:31-70.

Breden, L. H., Technical Standards Coordinator, Polytetrafluoroethylene (PTFE) plastic lined steel pipe and fittings, Nat. Bur. Stand. (U.S.), Prod. Stand. 33-70, 12 pages (Mar. 1971) 10 cents, SD Catalog No. C13.20/2:33-70.

Breden, L. H., Technical Standards Coordinator, Fluorinated ethylenepropylene (FEP) plastic lined steel pipe and fittings, Nat. Bur. Stand. (U.S.), Prod. Stand. 34-70, 12 pages (Mar. 1971) 10 cents, SD Catalog No. C13.20/2:34-70.

Breden, L. H., Technical Standards Coordinator, Poly(vinylidene fluoride) ($PVF_2$) plastic lined steel pipe and fittings, Nat. Bur. Stand. (U.S.), Prod. Stand. 35-70, 12 pages (Mar. 1971) 10 cents, SD Catalog No. C13.20/2:35-70.

Carter, G. C., Kahan, D. J., Bennett, L. H., Cuthill, J. R., Dobbyn, R. C., The NBS alloy data center: permuted materials index, Nat. Bur. Stand. (U.S.), Spec. Publ. 324, 683 pages (Mar. 1971) $7, SD Catalog No. C13.10:324.

Cassidy, M. D., Calibration and test services of the National Bureau of Standards, Nat. Bur. Stand. (U.S.), Spec. Publ. 250-1970 Edition, 209 pages (Dec. 1970) $2, SD Catalog No. C13.10:250. Supersedes NBS Miscellaneous Publication 250-1968 Edition.

Franklin, A. D., Bennett, H. S., Editors, ARPA-NBS Program of research on high temperature materials and laser materials, January 1 to June 30, 1970, Nat. Bur. Stand. (U.S.), Tech. Note 565, 84 pages (Jan. 1971) 75 cents, SD Catalog No. C13.46:565.

Freeman, D. H., Zielinski, W. L., Jr., Editors, Separation and purification section: Summary of activites, July 1969 to June 1970, Nat. Bur. Stand. (U.S.), Tech. Note 549, 86 pages (Jan. 1971) 75 cents, SD Catalog No. C13.46:549.

Furcolow, W. H., Technical Standards Coordinator, Hinged interior wood door units, Nat. Bur. Stand. (U.S.), Prod. Stand. 32-70, 15 pages (Mar. 1971) 30 cents, SD Catalog No. C13.20/2:32-70.

Hicho, G. E., Yakowitz, H., Rasberry, S. D., Michaelis, R. E., Standard reference materials: A standard reference material containing, nominally four percent austenite, Nat. Bur. Stand. (U.S.), Spec. Publ. 260-25, 22 pages (Feb. 1971) 30 cents, SD Catalog No. C13.10:260-25.

Hord, J., Voth, R. O., Tabulated values of cavitation B-factor for helium, $H_2$, $N_2$, $F_2$, $O_2$, refrigerant 114, and $H_2O$, Nat. Bur. Stand. (U.S.), Tech. Note 397, 116 pages (Feb. 1971) $1, SD Catalog No. C13.46:397.

Jennings, D. A., Power and energy measurement of repetitively pulsed lasers, Nat. Bur. Stand. (U.S.), Tech. Note 398, 10 pages (Mar. 1971) 25 cents, SD Catalog No. C13.46:398.

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